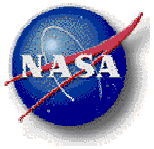


VAST Non-Real-Time Modeling

Larry Meyn

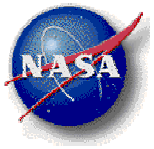
Shon Grabbe

Shawn Engelland

Terran Melconian

Outline of Presentation

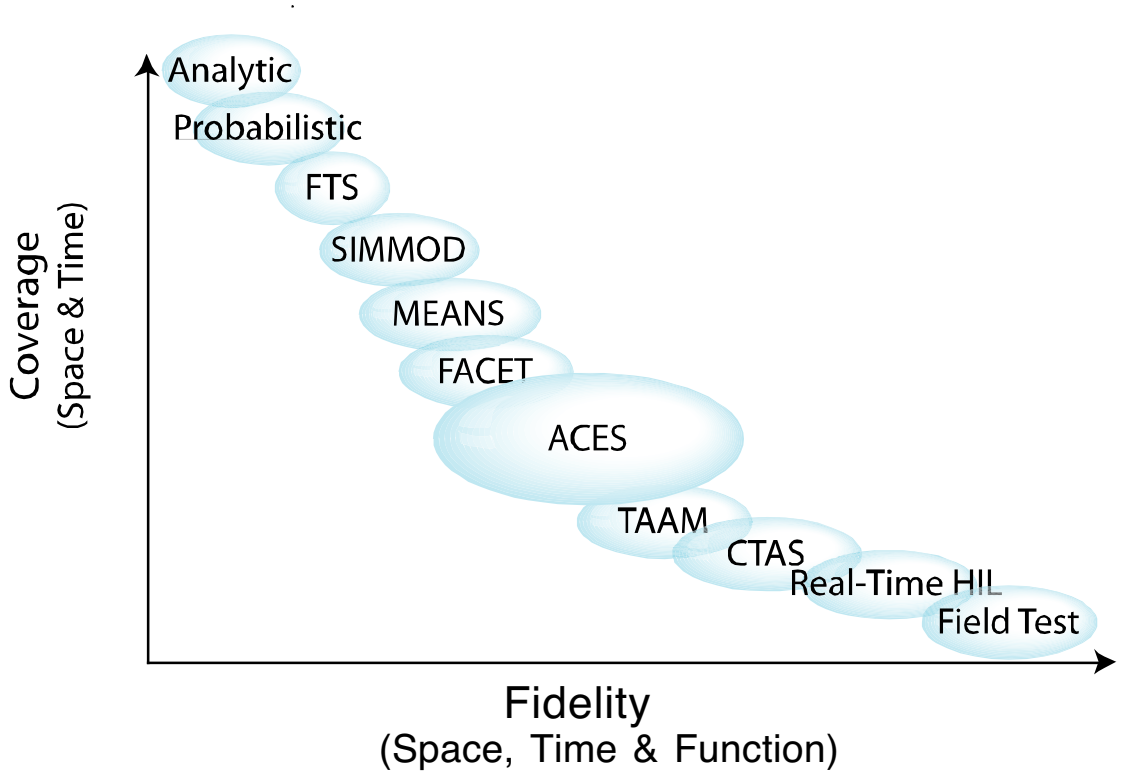
- **Non-Real-Time Modeling Needs**
- **Current Research**
  - **ACES**
  - **Other Non-Real-Time Modeling Research**
- **Highlight Presentations**
  - **Recent Developments in FACET**
    Shon Grabbe
  - **North Texas (NTX) Research Station Capabilities**
    Shawn Engelland
  - **MIT Extensible Air Network Simulation (MEANS)**
    Terran Melconian



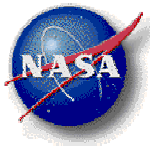
Non-Real-Time Modeling Needs

- **Modeling Requirements**
  - **Evaluation Criteria**
    Capacity, delay, safety, economics, environment, etc.
  - **Fidelity Requirements**
    Spatial, temporal, functional, discrete vs. continuous, etc.
  - **Coverage Requirements**
    Regional vs. national, stochastic & scenario variations, etc.
- **Data Requirements**
  - **Model Data**
    Sector geometry, aircraft performance, schedules, etc.
  - **Validation Data**
    Flight plans, weather, track data, TFM actions, etc.

The Modeling Spectrum



- **Modeling is a trade-off between coverage & fidelity**
- **Model choice is based on:**
  - **Concept development stage**
  - **Type of evaluation, i.e. capacity, safety, cost, interactions, etc.**
- **Comprehensive concept development and evaluation will require the use of several different models**
- **ACES is intended to fill a critical modeling role**
- **One modeling tool cannot be used for all evaluations**



Current Research

- **Airspace Concepts Evaluation System (ACES) Development**
  - **Our principal focus**
  - **Targeted toward modeling a large, complex NAS system with strong interaction between agents**
- **Other Non-Real-Time Modeling Efforts**
  - **Addressing the need for a spectrum of models**
  - **Leveraging other model development efforts**
  - **Identifying and developing models for inclusion in ACES**
  - **Addressing the need for model validation**

Airspace Concepts Evaluation System

- **Modular design will allow simulations to be tailored to meet specific research needs for scope and fidelity.**
- **HLA architecture will allow incorporation of legacy models, facilitate the reuse of models in other systems and allow for future integration with other HLA systems.**
- **Designed to model the interactions of NAS agents that can lead to non-linear system behavior.**
- **Forsakes the short-term benefits of augmenting legacy simulations in order to develop a modeling tool capable of evaluating a wide range of future ATM concepts.**

A long-term commitment to provide a flexible, scalable, standards-based modeling tool for evaluating ATM concepts.

Reference: Sweet, D. N., Manikonda, V., Aronson, J., Roth, K. and Blake, M., "Fast-Time Simulation System for Analysis of Advanced Air Transportation Concepts," AIAA 2002-4593, Aug. 2002.

Other Non-Real-Time Modeling Efforts

- **Cognitive Human Performance Modeling**
  - **Human/team performance model enhancements in APEX**
  - **Modeling of the Advanced Airspace Concept (NARI & SJSU)**
- **Stochastic Simulation**
  - **Terminal, weather and TFM enhancements in MEANS (MIT)**
  - **Development of probabilistic and stochastic models (ARC)**
- **Environmental Models**
  - **Noise, emissions & wake vortex (ARC)**
- **Validation of new and existing airspace models**
  - **Selection of datasets for a typical day (Metron Inc.)**
  - **Identification of critical parameters for model validation (GMU)**

References:

Meyn, L., "Probabilistic Methods for Air Traffic Demand Forecasting," AIAA 2002-4766, Aug. 2002.

Mueller, E. R. and Chatterji, G. B., "Analysis of Aircraft Arrival and Departure Delay Characteristics," AIAA 2002-5866, Oct. 2002.

Roy, S., Sridar, B. and Verghese, G. C., "An Aggregate Dynamic Stochastic Model for an Air Traffic System," To be published.

Highlight Presentations

- **Recent Developments in FACET**
  Shon Grabbe
- **North Texas (NTX) Research Station Capabilities**
  Shawn Engelland
- **MIT Extensible Air Network Simulation (MEANS)**
  Terran Melconian